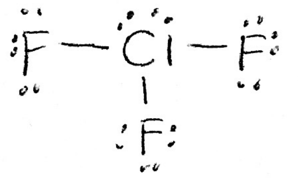
Chemistry 129 Quiz #5 – 25 points

Name: Key

1. (12 pts) Draw the Lewis structures of the following: **ClF_3, N_2O, and XeF_2.** Determine the electron group and molecular geometries and hybridization of the central atom. Is the molecule polar?

(a) ClF_3

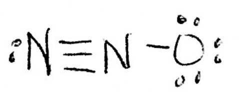
$ve = 7e + 3(7e^-) = 28e^-$



Electron Group Geometry: trigonal bipyramidal
Molecular Geometry: T-shaped
Polar or Nonpolar?: polar
Hybridization of Cl: sp^3d

(b) N_2O

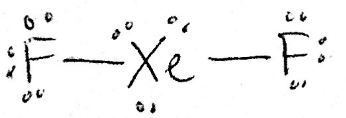
$ve = 2(5) + 6 = 16e^-$



Electron Group Geometry: linear
Molecular Geometry: linear
Polar or Nonpolar?: polar
Hybridization of N: sp

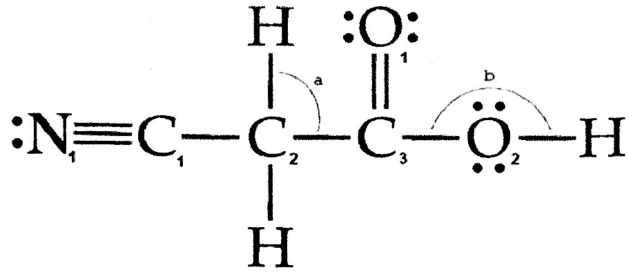
(c) XeF_2

$ve = 8e^- + 2(7e) = 22e^-$



Electron Group Geometry: trigonal bipyramidal
Molecular Geometry: linear
Polar or Nonpolar?: nonpolar
Hybridization of Xe: sp^3d

2. (7 pts.) (a) What are the hybridizations of the **three carbon** atoms, the **two oxygen** atoms, and the **nitrogen** atom?



C1: sp
C2: sp^3
C3: sp^2

O1: sp^2
O2: sp^3

N1: sp

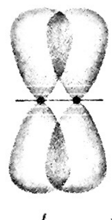
(b) How many sigma bonds and pi bonds does the molecule have?

8 sigma bonds   3 pi bonds

(c) Which bond angle is smaller a or b? Why?

(b) is the smaller angle. Both O (#2) & C (#2) have a tetrahedral electron-group geometry. Based on that the predicted angles are 109.5° but O has two nonbonding group & two bonding group which exert greater repulsion so the bond H–O–H bond angle is < 109.5°

3. (4 pts.) (a) Identify the following as a sigma bond or pi bond? (b) Would it be easier to rotate around a **σ** bond or around a **π** bond? Why? (c) Which one is generally stronger? Why?



π bond

σ bond

(b) σ is easier to rotate because all electron density is concentrated on internuclear axis.

(c) σ is stronger because the overlap is more efficient.

4. (2 pts.) Rank the following in order of increasing length and increasing strength:

N=N N≡N N—N

$N\equiv N < N=N < N-N$ → length

$N-N < N=N < N\equiv N$ → strength